

Accredited

# AS & A LEVEL

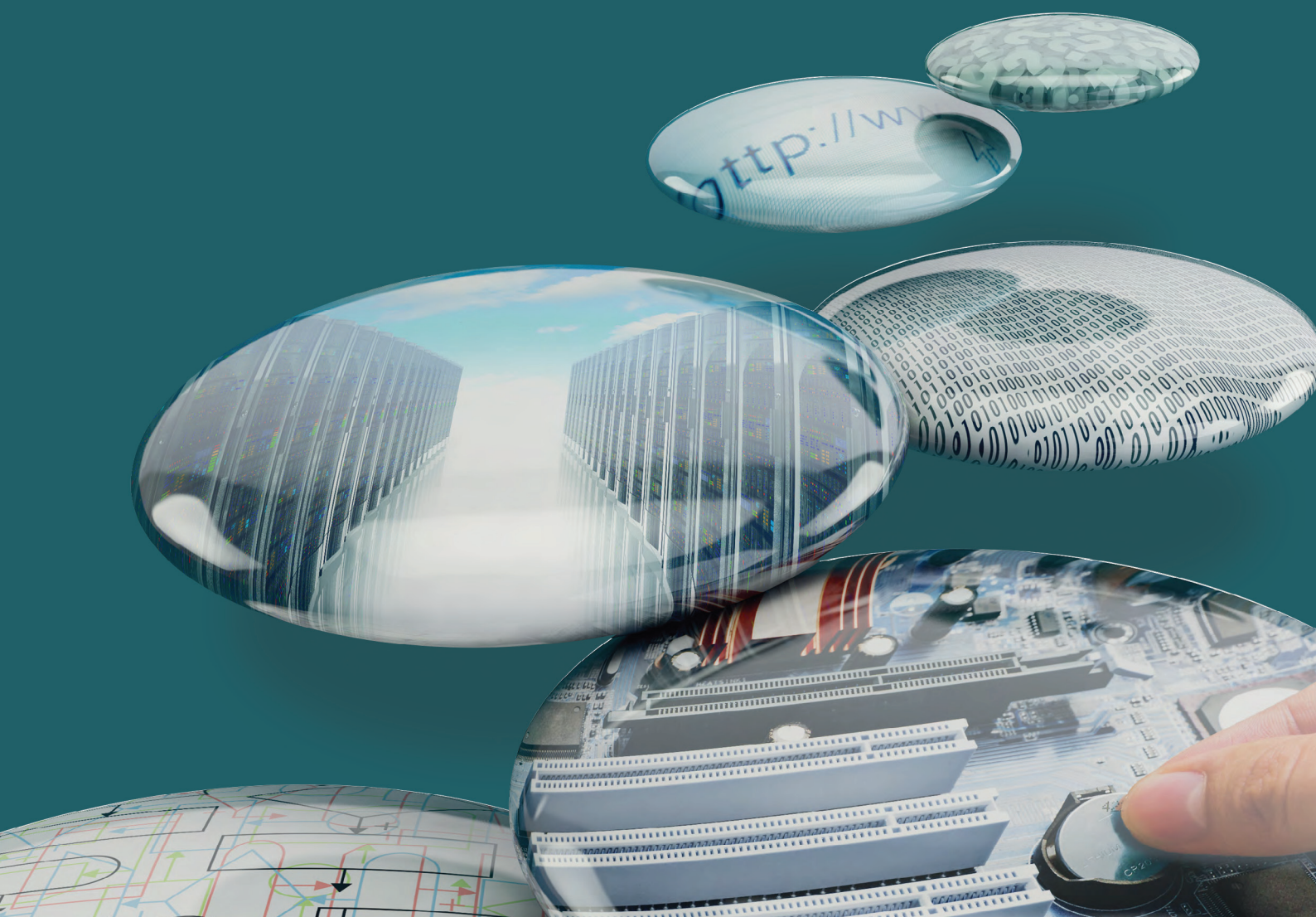
*Topic Exploration Pack*

H046/H446

# COMPUTER SCIENCE

Theme: Computational Methods

September 2015



**CAMBRIDGE**  
UNIVERSITY PRESS  
[www.cambridge.org](http://www.cambridge.org)

**OCR**  
Oxford Cambridge and RSA

We will inform centres about any changes to the specification. We will also publish changes on our website. The latest version of our specification will always be the one on our website ([www.ocr.org.uk](http://www.ocr.org.uk)) and this may differ from printed versions.

Copyright © 2015 OCR. All rights reserved.

#### Copyright

OCR retains the copyright on all its publications, including the specifications. However, registered centres for OCR are permitted to copy material from this specification booklet for their own internal use.

Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered company number 3484466.

Registered office: 1 Hills Road  
Cambridge  
CB1 2EU

OCR is an exempt charity.

# Contents

Contents .....	3
Computational Methods .....	4
Task 1 Eating a biscuit.....	4
Task 2 .....	4
Task 3 Backtracking.....	6

This Topic Exploration Pack should accompany the OCR resource 'Computational Methods' learner activities, which you can download from the OCR website.



*This activity offers an  
opportunity for English  
skills development.*



# Computational Methods

Here are general descriptions for the following tasks.

<http://ocw.mit.edu/resources/res-tll-004-stem-concept-videos-fall-2013/videos/problem-solving/basic-programming-techniques/>

<http://www.cs.iit.edu/~cs100/ProblemSolving.pdf>

Features that make a problem solvable by computational methods.

<http://www.mutiwingspan.co.uk/as1.php?page=problem>

Problem Recognition. The first part of the system life cycle covers this, check problem to be solved is the actual problem to be solved and then ...

Problem Decomposition. Top down design will cover both problem decomposition and divide and conquer.

Use of divide and conquer.

## Task 1- Eating a biscuit

Create a divide and conquer diagram (top down design) for eating a biscuit (The biscuits are in the kitchen, in a sealed packet in a cupboard that is too high for you to reach)

Break down the steps for each task i.e. getting to the cupboard, opening the packet, putting the biscuits on a plate (they can't eat them out of the packet, it's not civilised).

Use of abstraction. OOP defining a generic data type for the purpose of sub classes that will be given concrete methods.

<http://interactivepython.org/runestone/static/pythonds/Introduction/introduction.html>  
(about five 'clicks' down is a good bit about why use abstraction)

## Task 2

Using a class diagram, create an abstract class called biscuit and decide what sub-types there could be. Will there be any sub-sub-types? Yes.

No real criteria for being a biscuit, used to be cakes were soft and biscuits were hard but then there came Jaffa cakes defined as a biscuit.



Suggestions if they have trouble getting started.

Digestives, chocolate digestives, milk chocolate or dark chocolate, milk chocolate with a plain biscuit or milk chocolate with a chocolate biscuit. Use ingredients for methods.

Size or shape could be an alternative way of dividing classes

Learners should apply their knowledge of :-

- **backtracking** – backtracking is used in a declarative type of programming language that will allow for more than one solution to be found, if a solution is found/not found the program will 'backtrack' and explore other paths/possibilities to try to find alternatives.  
<http://www.cis.upenn.edu/~matuszek/cit594-2012/Pages/backtracking.html>
- **data mining** - the process of looking for general trends in large sets of data.  
<http://www.anderson.ucla.edu/faculty/jason.frand/teacher/technologies/palace/datamining.htm>
- **heuristics** - think about it and try different alternatives, use common sense, generalise rather than be specific. <http://www.education.com/reference/article/problem-solving-strategies-algorithms/>
- **performance modelling** - designing test criteria to see if a program/ task is successful or not. <http://www.pmn.net/wp-content/uploads/logic-models-a-tool-for-telling-your-programs-performance-story.pdf>
- **pipelining** – pipelining is the same as running a multi-tasking system, a task can be in one of three states: Running, where the task is being processed. Ready, where it waiting to be processed. Blocked, where it is awaiting an input. A possible way of utilising multi-core processors more efficiently. <http://msdn.microsoft.com/en-us/library/ff963548.aspx>  
[http://link.springer.com/chapter/10.1007%2F978-3-642-24322-6\\_14#page-1](http://link.springer.com/chapter/10.1007%2F978-3-642-24322-6_14#page-1)
- **visualisation** - visualisation is used to give a different view in order to solve problems.  
<http://www.google.co.uk/url?sa=t&rct=j&q=visualisation%20in%20programming%20methods&source=web&cd=4&cad=rja&uact=8&ved=0CEAQFjAD&url=http%3A%2F%2Fhrcak.srce.hr%2Ffile%2F69453&ei=6KY3VJWwEpPhaNS7gbgB&usq=AFQjCNElCK5fNDaXAF5a1VNkgzldEqkFuA&bvm=bv.76943099,d.d2s>



**Task 3 – Backtracking**

For steps to be shown working through the example students should use

Solution to first example:

Attempt to solve cake (X, Battenberg)

Finds X = Jeremy

Sets X = Jeremy

Backtracks to try to find another solution

Finds X = Kim

Sets X = Kim

Facts

Biscuits (Custard creams)

(Digestive)

(Garibaldi)

Cakes (Victoria sponge)

(Battenberg)

(Chocolate)

Eats (Anthony, Custard creams)

(Cilla, Digestive)

(Jeremy, Battenberg)

(John, Garibaldi)

(Kim, Battenberg)

(Roger, Victoria sponge)

Rules Likes biscuits Eats(X, Y) if Biscuits(Y)

Likes cake Eats(X, Y) if Cakes(Y)

Show the steps taken to get the results of:

Likes cake (X, Battenberg)

Likes biscuits (Roger, Y)

Likes cake (X, Chocolate)

Likes biscuits (X, Hobnobs)

Add another fact, another rule and a query using that rule.

Version 1





We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

If you do not currently offer this OCR qualification but would like to do so, please complete the Expression of Interest Form which can be found here: [www.ocr.org.uk/expression-of-interest](http://www.ocr.org.uk/expression-of-interest)

#### **OCR Resources: *the small print***

OCR's resources are provided to support the teaching of OCR specifications, but in no way constitute an endorsed teaching method that is required by the Board, and the decision to use them lies with the individual teacher. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources.

© OCR 2015 - This resource may be freely copied and distributed, as long as the OCR logo and this message remain intact and OCR is acknowledged as the originator of this work. OCR acknowledges the use of the following content: Thumbs up and down icons: alexwhite/Shutterstock.com

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: [resources.feedback@ocr.org.uk](mailto:resources.feedback@ocr.org.uk)







## OCR customer contact centre

General qualifications

Telephone 01223 553998

Facsimile 01223 552627

Email [general.qualifications@ocr.org.uk](mailto:general.qualifications@ocr.org.uk)



A DIVISION OF  
CAMBRIDGE ASSESSMENT

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.

©OCR 2015 Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England.  
Registered office 1 Hills Road, Cambridge CB1 2EU. Registered company number 3484466. OCR is an exempt charity.